# Satellite Observations of the Southeast Pacific Intertropical Convergence Zone

David Halpern
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA 91109
U.S.A.

The Southeast Pacific intertropical convergence zone (SITCZ) occurred in March and April during 1993 – 1999 in the 8°S – 2°S, 130°W – 90°W region when rainfall was above 2 mm $d^{-1}$, sea surface temperature was greater than 27 °C and surface wind was convergent. During 1993 – 1996, which were normal conditions, rainfall occurred above the 2 mm $d^{-1}$ threshold only in March and April when the wind was convergent ($3.3x10^{-6}$ $s^{-1}$), rainfall was 3.3 mm $d^{-1}$, sea surface temperature was 27.3 °C, integrated water vapor was 45.3 mm, and integrated cloud liquid water content was 0.1 mm. Independent satellite measurements were used. A conceptual model of the SITCZ involves surface wind convergence created by sea surface temperature differences between the SITCZ and the equatorial cold tongue to the north and the waters to the south, in addition to convergence created when the moist atmosphere becomes convectively unstable when sea surface temperature was greater than 27 °C. Wind-generated mixing, westward Ekman transport, evaporation – precipitation, cloudiness, and downwind advection of cold air are considered to explain why the September – October sea surface temperature was 3.8 °C lower than in March – April because incident solar radiation is maximum twice each year. Time variations of convergence and, to a lesser extent, rainfall had evidence of a biennial modulation of the annual cycle, with convergence and rainfall in phase.

During the May 1997 – May 1998 El Niño, which was the largest of its kind in the XXth century, 1997 was a year without a winter in the SITCZ. In the SITCZ in March – April 1998 sea surface temperature reached 29.1 °C, rainfall exploded to 8.7 mm $d^{-1}$, and integrated water vapor and integrated cloud liquid water content also reached supreme values of 59.2 and 0.15 mm, respectively. Highly anomalous conditions were caused by the southward migration of the Northern Hemisphere intertropical convergence zone (ITCZ). During the June 1998 – December 1999 La Niña, rainfall in March – April 1999 reached 5.9 mm $d^{-1}$, which was only smaller than those measured during El Niño, creating an enigma because magnitudes of the other variables were approximately normal and the ITCZ remained north of the equator.